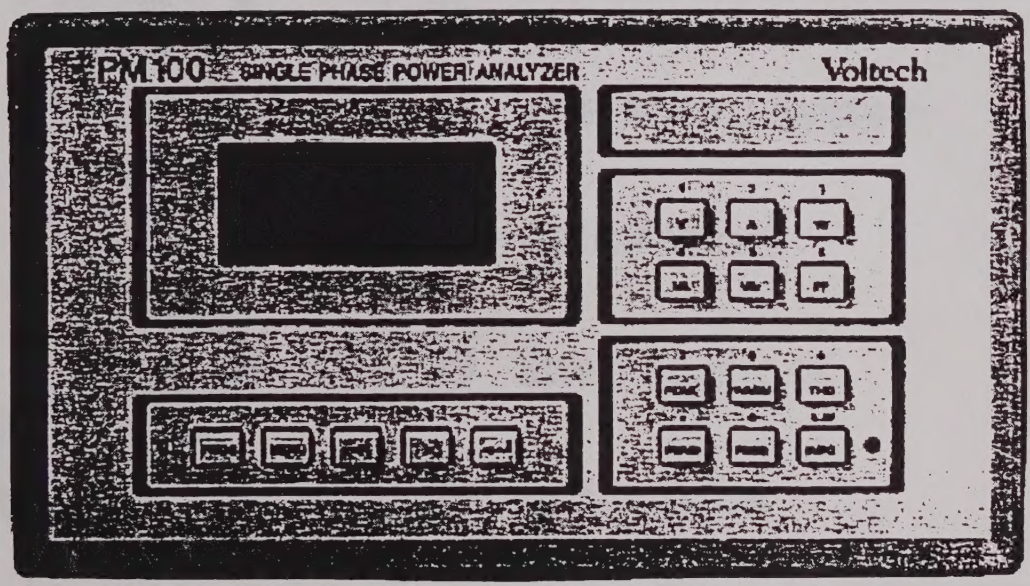
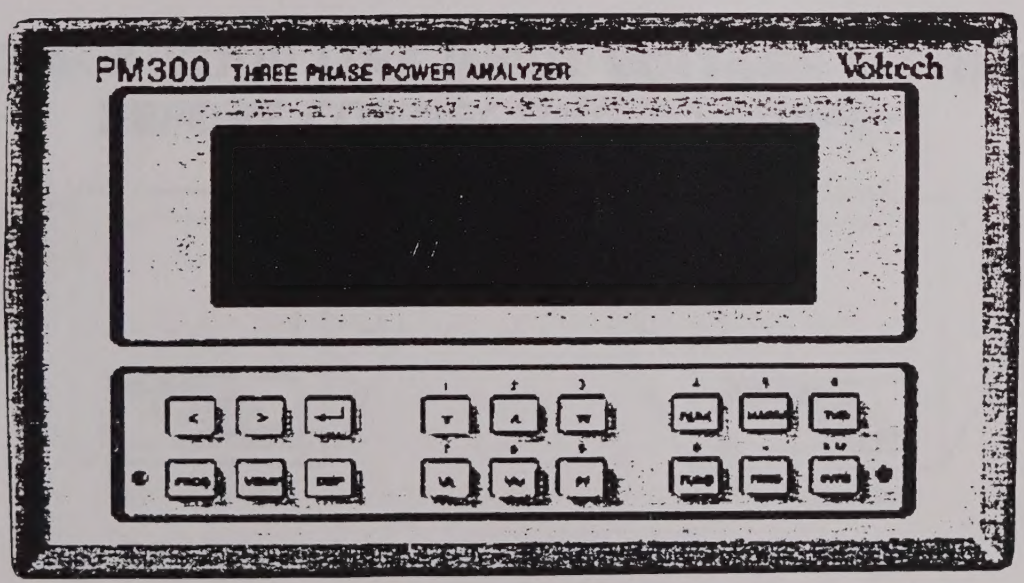
Voltech™

PM100/PM300





Contents

3 Essential Information

5 Getting Started

11 Function Keys

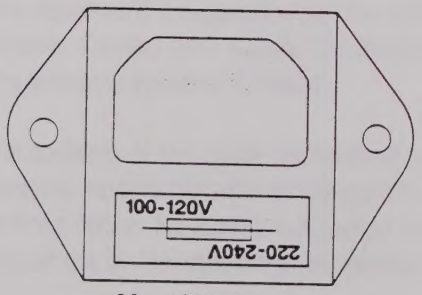
13 The Menu System

17 Calibration

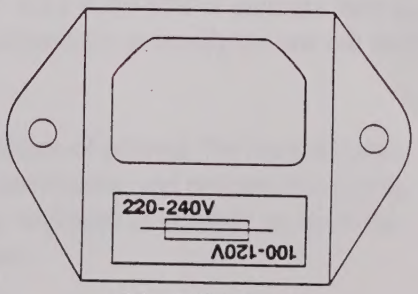
19 Specifications

23 Accessories

CHECK YOUR LINE INPUT VOLTAGE SETTING BEFORE CONNECTING TO SUPPLY!



90 - 132V Supply



195 - 265V Supply

Pull out fuse holder drawer and rotate to change setting.

ELECTRIC SHOCK RISK

Only qualified personnel should install this equipment, after reading and understanding this users guide. These operating instructions should be adhered to. If in any doubt, consult your supplier.

IMPORTANT SAFETY INSTRUCTIONS

- **WARNING:** The analyzer must be earthed. Only insert the power lead into a socket with a protective ground contact.
- Replace fuse only with the same type and rating – 315mAT.
- Connect the power lead before making connections to the measuring sockets or interfaces (where fitted).
- Do not attempt to change a plug-in interface or remove the outer covers without first turning the power off and removing all external connections.
- Ensure that all power and test leads are in good condition and free from damage before use.
- Refer servicing only to qualified personnel who understand the danger of shock hazards. When the instrument is removed from its case, hazardous voltages are present. The electronic circuitry of this instrument is fully floating with respect to ground. If the instrument is opened and dangerous voltages (above 50V peak) are applied to the input terminals then all the circuitry must be considered 'Live'.
- The PM100 and PM300 power analyzers have been constructed in compliance with the requirements of EN61010-1 Pollution Degree 2, Installation Category II, FOR INDOOR USE ONLY. This ensures the safety of the instruments and the user when normal precautions are followed. It is the responsibility of the user to ensure the compliance of the installation with any local acts or bylaws in force.

Please note:

This equipment is supplied under the warranty conditions in force at the time of purchase from your supplier. Contact your supplier for details. Any attempt to disassemble or modify the unit will render any warranty agreement invalid.

The contents of this guide are believed to be accurate at the time of printing. The manufacturers, however, reserve the right to change the content, product specification, and performance criteria, without notice. No liability is accepted for the inappropriate, negligent, or incorrect set-up of the instrument by the user, either by manual or automated means.

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Getting Started.

Thank you for purchasing a Voltech Power Analyzer. Your analyzer comes supplied with:

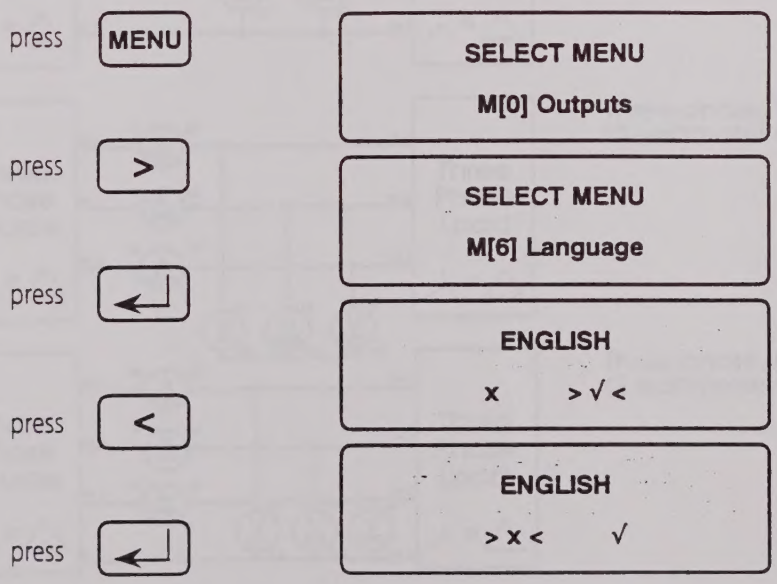
1 **This manual.**
2 **A power lead.**
3 **Safety insulated test leads (PM100 - 2 red, 2 black. PM300 - 6 red, 6 black).**
4 **Safety crocodile clips**
5 **A Voltech product registration card.**

Please report any missing items to your Voltech product supplier immediately. When you return your product registration card to Voltech we will ensure that you continue to receive news of the latest applications software and hardware available for your power analyzer.

PM100 and PM300 power analyzers are ideal for making accurate measurements on most electrical and electronic equipment. Measurements on pulsewidth-modulated motor drives present special problems however, and we recommend the use of the special "PWM Mode" on other Voltech analyzers for this application.

All PM100/PM300 power analyzers are supplied with a power lead, and the line voltage selector switch and menu language suitable for use in their intended destination country. Please check the line voltage setting on the IEC line socket at the back of the power analyzer now.

To Change Language.



The menu will now be displayed in the alternative language available in your power analyzer.

Adjusting the LCD display contrast.

Switch the analyzer ON. Before pressing any other keys, use the [<] and [>] keys to adjust the display contrast to suit your angle of view.

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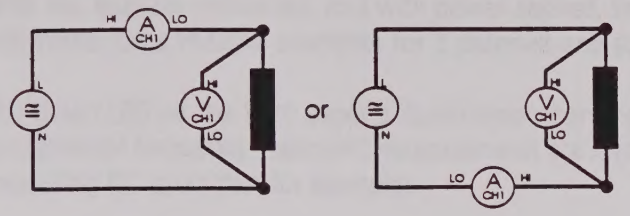
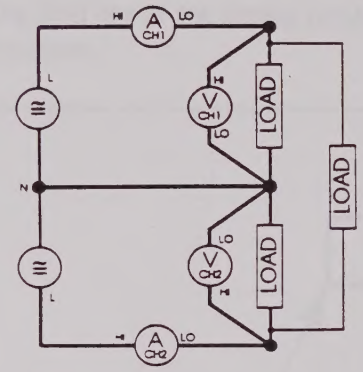
https://archive.org/details/manualsplus_13138

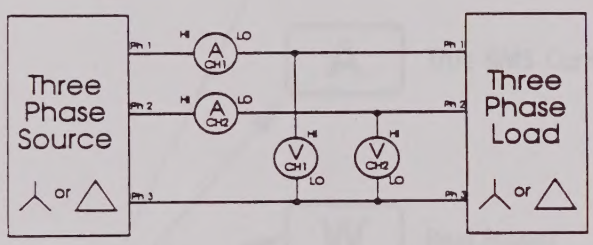
Connect the analyzer to the load as shown. Direct connection to the analyzer's voltage and current inputs gives the best accuracy. For higher current applications that require current transformers or external shunts, see page 14.



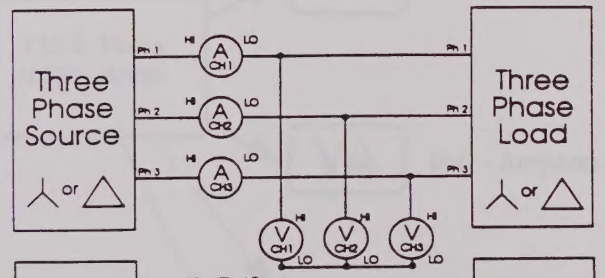
Single-phase, Two-wire and DC measurements.



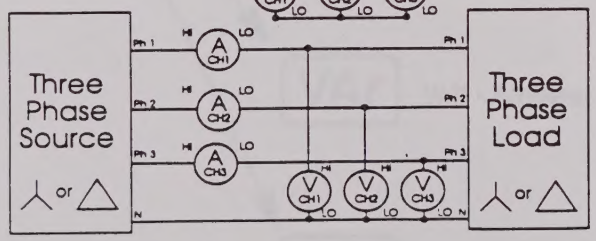
Single-phase, Three-wire.*



Three-phase, Three-wire * (2 wattmeter method)



Three-phase, Three-wire.* (3 wattmeter method)



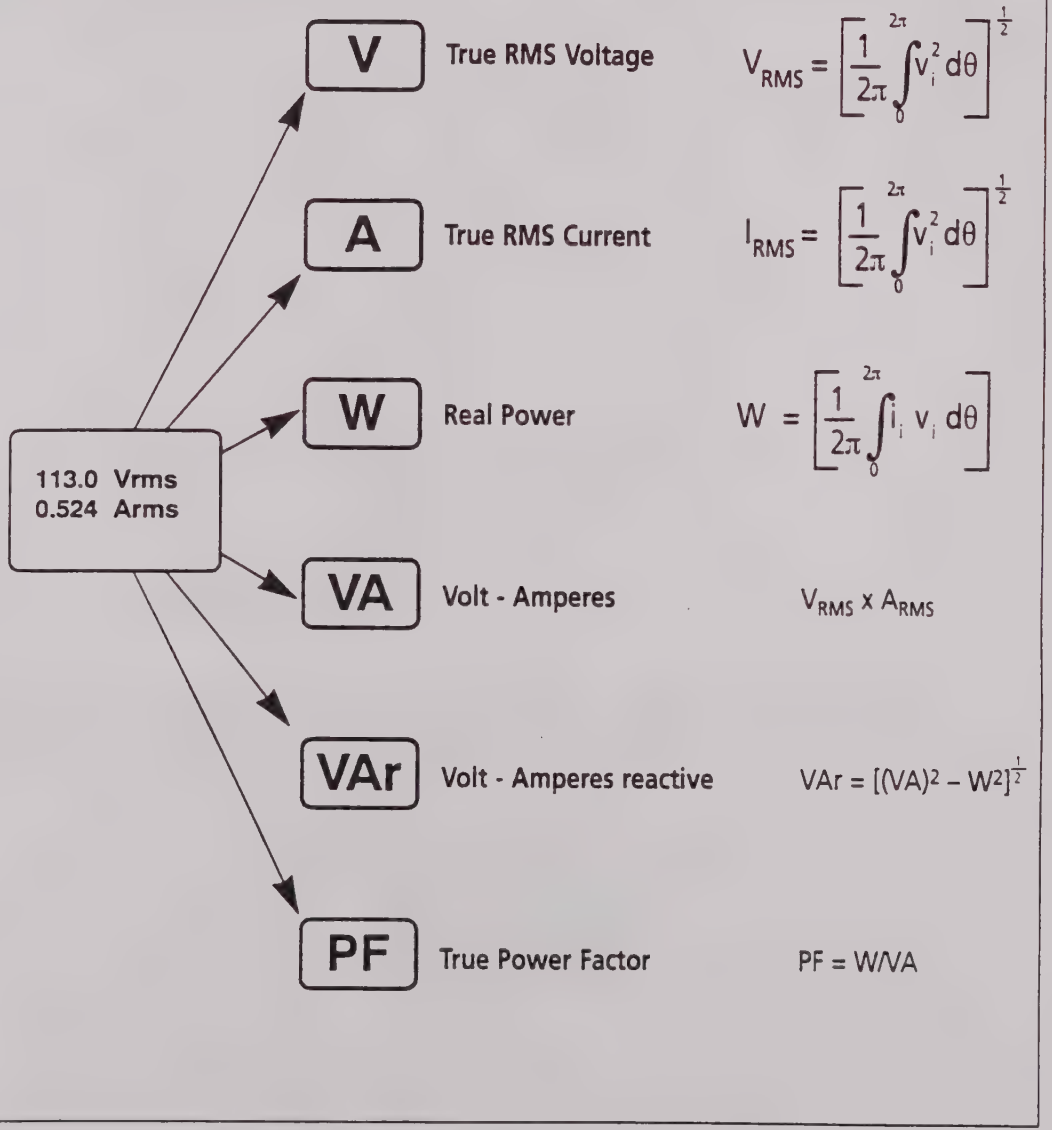
Three-phase, Four-wire.* (3 wattmeter method)

* PM300 only. See page 13 for selection of wiring mode.

With the analyzer connected, and with power applied, the default display shows Volts, Amps and Watts. On a PM300, quantities for 3 channels and sum are shown.

The Green LED on the front panel is illuminated when the analyzer has detected a stable fundamental frequency. Harmonic measurements are invalid when this LED is not lit (when measuring DC quantities for example).

The third line of the display can be changed to show any of the 6 basic measurement functions:



The frequency of the input waveform is obtained using the 'FREQ' key. The lowest of the frequencies detected on the Channel 1 V and A inputs is displayed. This frequency is used as the fundamental for harmonic analysis.

FREQ **Frequency**

The fundamental (1st harmonic) component of the 6 basic measurements are quickly shown by using the 'FUND' key.

FUND **Fundamental value. V.f, A.f, W.f, VA.f, Var.f, PF.f**

PF.f is the power factor due to the fundamental components of voltage and current. This is equivalent to cosø in a sinewave system. Cosø has a sign to denote leading or lagging current, and the convention used is shown below:

	0°	–90°	–180°	–270°	–360°
W	+	–	–	+	
PF.f	–	–	+	+	
VAr.f	+	+	–	–	

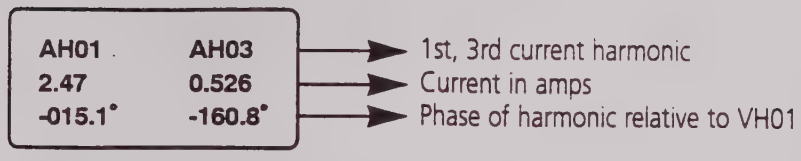
For Watts, + or – indicates the direction of power flow.
For PF.f, + indicates that I leads V (Capacitive).
For VAr.f + indicates an inductive load.

The sign used to indicate fundamental power factor may be reversed in menu 4.

Four further types of measurement are available. These are associated with only specific basic measurements. Attempting to show 'VA' 'PEAK' for example will result in a parameter error.

PEAK **Peak value of the waveform V pk, A pk. Display of crest factor may be selected in menu 4. V cf, A cf . Press 'PEAK' again to cancel.**

HARM Displays Voltage (VHxx), Current (Ahxx), and Power (Whxx) harmonics. Press 'HARM' again to cancel harmonic display



Use the [<] and [>] keys to scroll through harmonics 0 (dc) to 50. Harmonic amplitude can be shown as absolute values by selecting 'V/A/W' in menu 2.

THD Total Harmonic Distortion. V thd, A thd. The power analyzer automatically selects the most accurate method of calculation, depending on the level of THD. Press THD again to cancel THD display.

$$THD > 6\% \quad THD = \frac{\sqrt{(RMS^2 - H_{01}^2)}}{H_{01}} \times 100\%$$

$$THD < 6\% \quad THD = \frac{\sqrt{(H_{02}^2 + H_{03}^2 + H_{04}^2 + \ldots)}}{H_{01}} \times 100\%$$

INTG Displays integrated values. Ah, Wh, VAh, VArh, PF (Average) and fundamentals are valid. The period of integration is set in menu 2. Pressing the 'INTEG' key starts integration, and displays any of the integrated values during integration. Pressing the 'INTEG' key again returns the display to normal mode, integration continues in the background until the time set in menu 2 is reached. The yellow LED is lit when the integrator is running. Press and HOLD the 'INTEG' key to stop integration.

Function Keys

PROG — Use this key to toggle between default (LED OFF) and stored settings (LED ON). Press and HOLD.

MENU — Enter and exit the menu system. See page 13.

< > — Move through menus, select settings etc. Clear erroneous menu data.

↵ — HOLD key (Toggle). Accept a menu selection.

DISP — PM300 only. Selects Channel on Display. Toggles display of Σ quantities and Neutral Amps.

For waveform display, the 'DISP' key sequences through the following displays:

1/ V & A	CH1
2/ V & A	CH2
3/ V & A	CH3
4/ V	CH1, CH2 and CH3
5/ A	CH1, CH2 and CH3
6/ V & A	CH1, CH2 and CH3

The MENU System

MENU Allows access to the analyzer menu system. All settings are stored when the analyzer is switched off, and may be restored by pressing the 'PROG' key. The following menu options are available.

M[0] Outputs

Select plug in interface options.
Options are defined in the user manual supplied with the separately purchased interface.

M[1] Inputs

1ph 2W	>x< or √	See connection diagram
1ph 3W	>x< or √	See connection diagram
3ph 3W	>x< or √	See connection diagram
3ph 4W	x or >√<	See connection diagram
External Shunt	>x< or √	
Voltage Scaling	>x< or √	Enter scale factor
Current Scaling	>x< or √	Enter scale factor

M[2] Modes

Inrush Current	>x< or √	
Integration Time	HH:MM	Enter time (01:00)
Ballast Mode	>x< or √	50Hz or 60Hz
Harmonic Mode	>%< or V/A/W	
Waveform	>x< or √	
Barchart	>x< or √	

M[3] Display

Upper Function	>V rms<
Middle Function	>A rms<

M[4] Key Options

PF Leading	>–< or +	(Sign of PF when I leads V)
Peak	>pk< or cf	(Display peak or crest factor)

M[5] Calibration

Password	>3000<

M[6] Language

English	x or >√<

M[0] Outputs

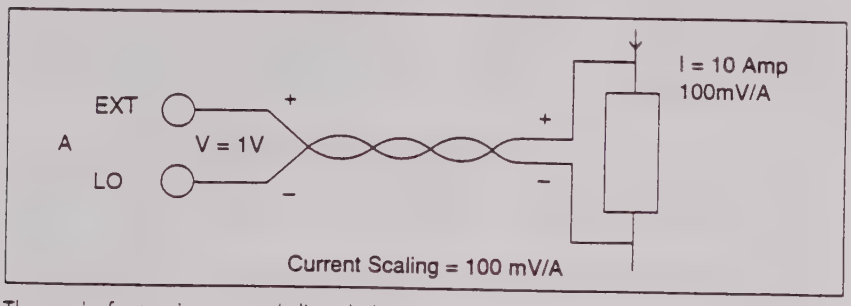
This menu is only available when a Voltech interface is fitted. For operating instructions, see the manual supplied with the interface.

M[1] Inputs

Allows scaling of the display to allow for external transducers.
Selects wiring mode (PM300 only).

External shunt.

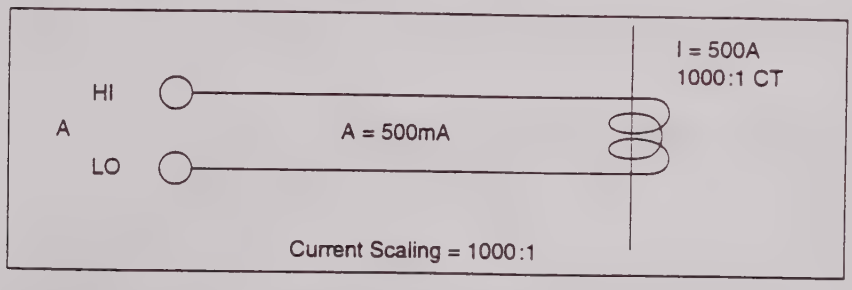
For use with external shunts and other devices that produce a voltage proportional to the current being measured (E.g. some DC coupled current transformers.) The proportional voltage is applied between the 'EXT' and 'LO' terminals.



The scale factor is entered directly in mV/A. A twisted pair connection is recommended to minimise noise pick-up. We recommend that voltage is connected to the voltage input when the external shunt feature is used.

Voltage Scaling and Current Scaling.

For use with voltage transformers / dividers and current transformers. Connect to the V HI and LO terminals for voltage probes, and to the A Hi and LO terminals for current probes.



M[2] Modes Special operating modes of the analyzer.

Inrush Current

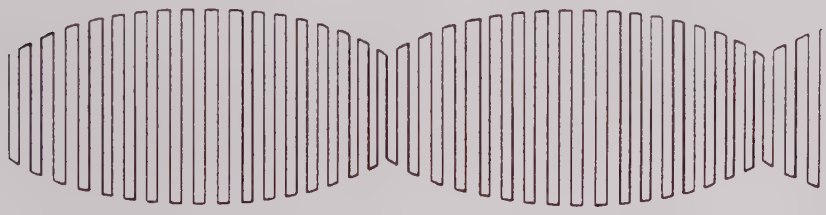
The analyzer continuously monitors the current channels and displays the largest peak current observed. Only the < and > keys operate to reset the display. Auto-ranging is disabled in this mode, so the expected peak value must be entered. If in doubt enter '200' Amps when prompted, and then reduce this value to improve resolution and accuracy.
'CURRENT OVERRANGE' is displayed if the selected peak value is exceeded.
Press 'MENU' and deselect Inrush Current mode to make other measurements.

Integration Time

This is the time that the integrator will run for. See the 'INTG' key.

Ballast Mode.

The output of electronic ballasts and some ultrasonic equipment consists of a high frequency waveform heavily modulated at the line frequency.



To make accurate measurements, the whole cycle at 50 or 60 Hz must be analyzed. To do this, select 'Ballast Mode' and chose 50 or 60 Hz. In this mode, 50 or 60Hz is always displayed when the 'FREQ' key is pressed.

Harmonic Mode

Harmonic amplitude may be displayed as a percentage (%) of fundamental current or in RMS Amps as desired.

Waveform Display Mode.

This mode displays one cycle of the input waveforms. The waveforms are automatically scaled to fit the display, voltage on CH1 always being the larger. Since the waveforms are scaled for easy viewing, they should not be used for comparative measurements. The peak values of the waveform are shown alongside.

Barchart Display Mode.

Displays bargraphs of voltage or current harmonics. All 50 harmonics are displayed, and individual detail can be displayed by pressing the < or > keys to scroll through the harmonics.

M[3] Display

The top and middle lines of the numeric display may be changed to show any of the basic measurement functions. For Example:

```
+ 234.5 W
123.6VA
50.03 Hz
```

M[4] Key Options.

PF Leading.

Normally the convention used is '+' means I leads V. This may be reversed by selecting '–' means I leads V. See the 'FUND' key.

Peak.

Pressing the 'PEAK' key normally displays the repetitive peak value of the voltage or current waveform. This may be changed here to display the Crest Factor, CF, where CF = Peak / RMS values of the waveform. For a sine wave the CF is 1.414.

M[5] Calibration

See page 17 for a full description of this menu.

M[6] Language

English or an alternative language may be selected for the menus.

Calibration

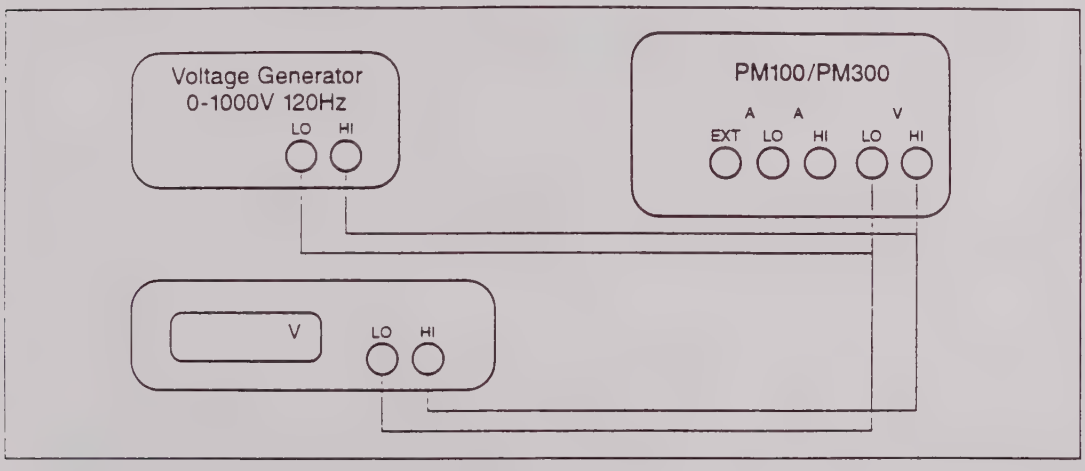
Calibration of your analyzer is valid for 12 month periods. If any input range is uncalibrated, the analyzer displays 'CALIBRATION ERROR' on power up. This may be bypassed by pressing the '↵' key.

Equipment required:

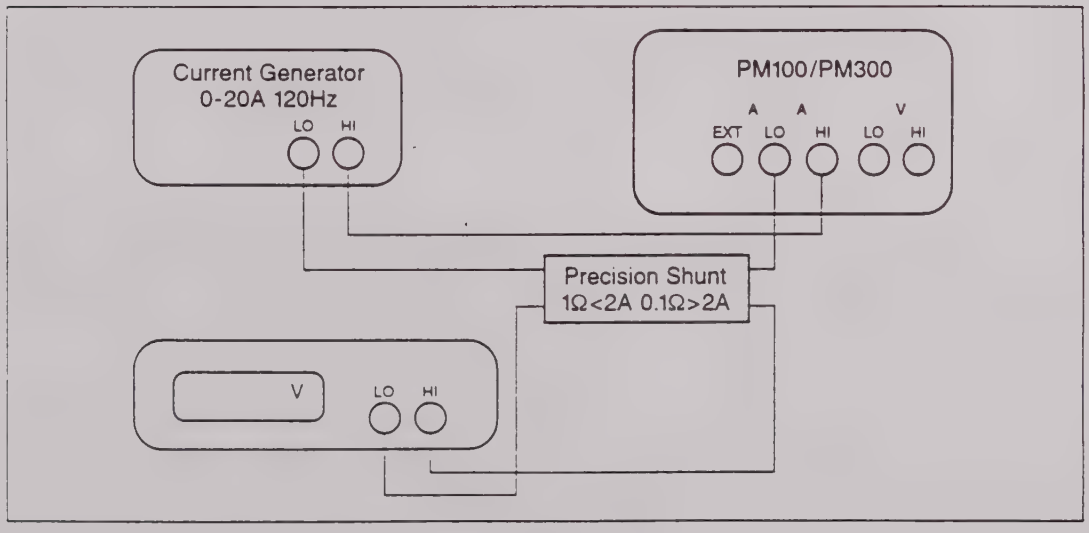
High accuracy (0.02%) true RMS volt meter.
0-20A Current Generator, 120Hz.
0-100V Voltage Generator, 120Hz
1.000Ω precision shunt. (For < 2A)
0.1000Ω precision shunt. (For > 2A)

Equipment Connections:

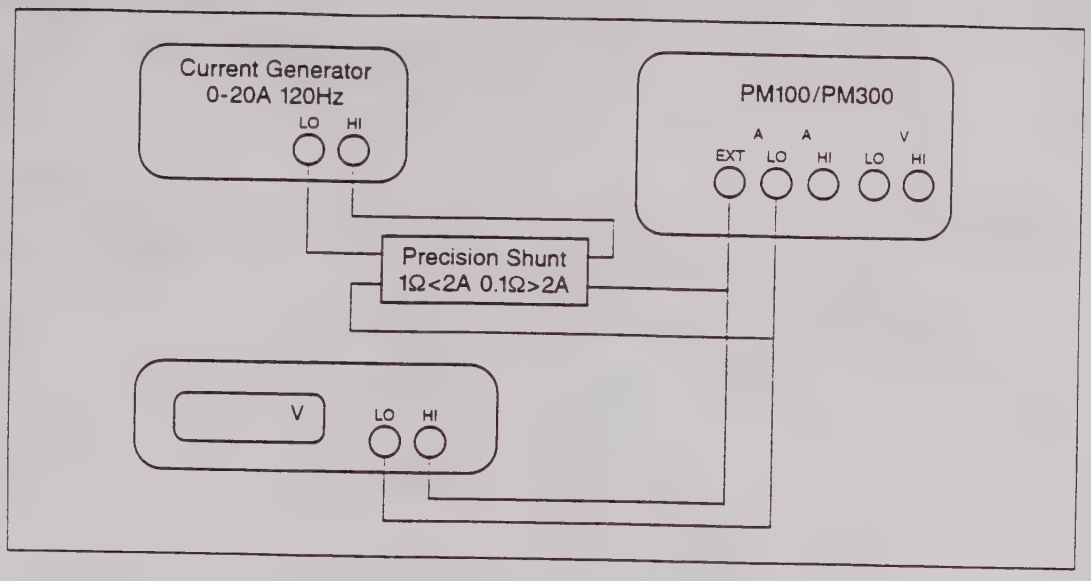
For voltage calibration:



For current calibration:



For current calibration (external shunt)



Calibration method:

1/ Select menu 5 and enter the password. The factory setting is '3000'.

2/ The password may then be changed. 'Change Password' >x< √

3/ The voltage ranges are then calibrated. 'CALIBRATE VOLTS' x >√<

4/ For each of the seven ranges per channel (VR0 to VR7), set up approximately the required voltage using the equipment connected as above for voltage calibration.

Enter the voltmeter reading into the PM100 or PM300 and press '↵'. Use < and > to delete incorrect entries.

The display will show 'BUSY' for a short time, followed by 'PASS' to continue or 'FAIL'.

If 'FAIL' is displayed, press '↵' to retry or ø to continue.

5/ To 'CALIBRATE AMPS' x >√< the process is similar for the current ranges A0 to A7. Connect the equipment as above for internal shunt calibration, and enter the current value which is voltmeter reading / shunt resistance.

6/ To 'CALIBRATE EXT' x >√<, ranges XR0 to XR7 connect as above for external shunt calibration and enter the current values = voltmeter reading / shunt resistance.

7/ Finally 'SAVE CALIBRATION' x >√< to store the new calibration constants.

Note: Any stage of the calibration may be omitted. New calibration constants will only be used where they are entered. Entering '0' for any value causes the previously stored calibration to be used for that range.

Specification

(at 23°C ±5°C, 30 minutes warm-up.)

Voltage

Ranges (auto ranging)		2Vrms to 1000V pk in 8 ranges : 7.5, 15, 30, 60, 120, 240, 480, 1000 Vpk
Accuracy	5Hz to 1kHz 5Hz to 50kHz*	±0.1% reading ±0.1% range ±10mV ±0.1% rdg ±0.1% rng ±10mV ±0.1%/kHz
Crest Factor		Up to 20
Max input	Continuous	1000V pk
	1 min	6kV pk
Input Impedance		>1MΩ in parallel with <10pF
Effects of Common Mode Voltage	500Vrms 120Hz 500Vrms 10kHz	Less than 500mV Less than 1V
Impedance to ground		Galvanic isolation. Capacitance approx. 100pF

Current

Ranges (auto ranging)		20mArms to 20Arms in 8 ranges : 0.1, 0.3, 0.9, 2.7, 8.1, 24.3, 72.9, 200.0 Apk
Accuracy (excluding Neutral)	5Hz to 1kHz 5Hz to 50kHz*	±0.1% reading ±0.1% range ±1mA ±0.1% rdg ±0.1% rng ±1mA ±0.2%/kHz
Crest Factor		Up to 20
Max input	Continuous	20Arms, 200Apk (16Arms when all three channels used on PM300)
	1 second	500Apk
Input Impedance		12.5mΩ on all ranges
Effects of Common Mode Voltage	500Vrms 120Hz 500Vrms 10kHz	Less than 1mA Less than 50mA
EXT. SHUNT		
Range		12.5mVrms to 2.0Vpk
Equivalence	12.5mV/A	
Accuracy	5Hz to 50kHz*	±0.1%rdg ±0.1%rng ±1mV ±0.2%/kHz
Max input	Continuous	250Vrms
Input Impedance		1MΩ on all ranges
Impedance to ground		Galvanic isolation. Capacitance approx. 100pF

*5Hz to 20kHz for the PM300 in three-phase, three-wire and three phase, four wire modes.

Power

Range	0 to 1,999GW
Accuracy	±0.2% rdg ±0.2% rng ±5mW ±0.3%/kHz

Apparent Power

Range	0 to 1,999GVA
Accuracy	±0.2% rdg ±0.2% rng ±5mVA ±0.3%/kHz

Reactive Power

Range	0 to 1,999GVAr
Accuracy	±0.2% rdg ±0.2% rng ±5mVAr ±0.3%/kHz

Power Factor

Range	0.000 to ±1.000
Accuracy	±0.004 ±0.2% rdg ± 0.2%kHz

Crest Factor

Range	1.000 to 19.999 (Ranges 2 to 8 only)
Accuracy	±2.0%

Peak Voltage and Current

Accuracy	±1%rdg ±1%rng ±0.2%/kHz (Ranges 2 to 8 only)

Inrush Current

Range	0-200A
Accuracy	±3.0% rdg ±3.0% rng ±50mA

Frequency

Range	5Hz to 50kHz*
Accuracy	0.2%

*5Hz to 20kHz for the PM300 in three-phase, three-wire and three-phase, four wire modes.

Harmonics

Range		0 to 50
Bandwidth	Fundamental	5Hz to 50kHz*
	Harmonics	10Hz to 250kHz
Accuracy	Fundamental Volts	±0.1% rdg ±0.1% rng ±10mV ±0.1%/kHz
	Amps	±0.2% rdg ±0.1% rng ±1mA ±0.2%/kHz
	Harmonics	±(0.2 ± 0.1/kHz)% of fundamental

THD

Range	0% to 999%
Accuracy	±0.4% ± 0.1%/kHz%

Integrator

Range	1min to 99hrs 59mins

Environment

	Operating	0 to +40°C
	Shipping	-20 to +60°C
Safety	Designed to comply with EN61010-1	
	Pollution Degree 2, Installation Category II	

Power Source

	110V	90V to 132V
	230V	195V to 265V
	Frequency	48Hz to 65Hz
	MAX. VA	25VA
	Fuse Type & Rating	315mAT

Dielectric Strength

	Input - Case	4kV AC 50/60 Hz for 1 minute.
	Input - Power Srce	4kV AC 50/60 Hz for 1 minute
	Power Srce - Case	2.9kV DC for 1 minute

*5Hz to 20kHz for the PM300 in three-phase, three-wire and three-phase, four wire modes.

Accessories available for the PM100 and PM300.

A number of interfaces have been designed for use with the PM100 and PM300 power analyzers:

IEEE488.2 Interface.

Full implementation of the IEEE488.2 bus communication standard using the latest National Instruments compatible circuits. Allows full control of the analyzer remotely. IEEE address may be any number from 2 to 30.

Centronics (parallel) and RS232 (serial) Interface.

The parallel connector (a 25 way D-type) connects to most printers with a centronics type interface — matrix, jet and laser. User selected text is printed when the ENTER key is pressed.
The RS232 connector (a 9 way D-type) may be used to connect to a serial printer, or to allow full remote control of the analyzer using the IEEE488.2 protocol. The baud rate (1200 to 19200) is selected from the front panel.

Chart Recorder and Alarm Contacts Interface

12 measurements may be output onto a 15-way D-type for connection to a chart recorder or data logger. Each measurement is scaled for MAX and MIN level from the front panel.
2 isolated alarm relay contacts are also provided (rated 50V @1A) for plant control. The relays may be programmed (via the front panel) to operate when any measurement exceeds a preset MAX or MIN level. Extra integration features are provided for load shedding and peak demand applications.

Voltech can also supply a range of current transformers:

CT1000

Precision AC 0.2% dual ratio current transformer. 100A:1A and 1000A:1A

CL1000

AC clamp-on current transformer. 1000A:1A

CL100

AC clamp-on current transformer. 100A:1A

Contact Voltech for details of the accessories and applications currently available.

8½ W x 5 H x 11 DEEP + 3" CABLES
L HINGES

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Issue 1.0 28.3.95

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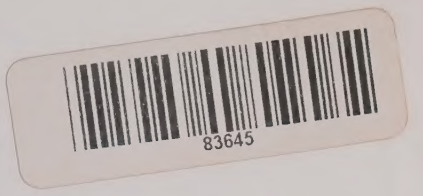
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